SPRING BRAKE MODULATING RELAY VALVE

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] This application relates to a combined or integrated spring brake modulating valve and relay valve that are contained in a single housing for an air brake system.

[0003] 2. Discussion of the Art

[0004] It is common in presently available brake circuits to employ a separate modulation valve with a relay valve or with a separate quick-release valve. For example, **FIG. 1** illustrates a six-by-four straight truck, i.e., a non-towing vehicle, that employs spring brakes for parking the vehicle and in which pressurized air is delivered to the spring brakes to release them during normal operation. As shown in **FIG. 1**, each wheel includes a brake chamber connected with a relay valve to provide air pressure to the drive axle and selectively control service application of the brakes. In addition, each wheel includes a spring brake chamber selectively supplied with air to release a large mechanical spring typically used for the park function. Air pressure to these spring brake chambers releases the mechanical spring and allows the vehicle to roll.

[0005] As is generally known in the art, if a primary circuit fails, it is desirable to take advantage of the spring brakes, yet modulate the operation of the spring brakes through a foot control valve. This is provided by the spring brake modulation valve so that the spring brakes are selectively applied through operation of the foot control valve. The secondary circuit controls the steer axle (not shown). This arrangement provides a desired braking action and modulation of the spring brakes when required.

[0006] **FIG. 2** illustrates a four-by-two or six-by-two straight truck configuration. Again, a spring brake modulation valve is used in conjunction with a separate spring brake quick release valve. It is evident from a comparison of **FIGS. 1 and 2** that different system configurations and plumbing arrangements are thus encountered by truck manufacturers even though the brake needs are not entirely dissimilar. Thus a need exists for simplified plumbing for the truck manufacturers that provides standardized installation across all of its vehicles. In addition, enhanced performance characteristics are always desirable.

SUMMARY OF THE INVENTION

[0007] The present invention provides an integrated spring brake modulating relay valve that simplifies known, multi-component systems.

[0008] More particularly, the valve includes a housing having a control port, supply port, delivery port, exhaust port, and primary and secondary circuit brake ports that communicate with a chamber in the housing. A first piston received in the housing moves in response to pressure from the control port. A second piston monitors the primary and secondary circuits and modulates spring brake pressure if the primary circuit fails. An exhaust valve is interposed between the supply and delivery ports and controls communication with the exhaust port to selectively supply and release the spring brakes.

[0009] The first or relay piston is connected to the second or modulating piston through a biasing spring. Thus, the pistons can operate in unison but are also adapted to move relative to one another for their particular functions.

[0010] A primary benefit of the invention is the ability to integrate separate components into a multi-component arrangement in a single housing.

[0011] Another benefit of the invention resides in the improved response time, while maintaining all of the features and benefits of known systems.

[0012] Yet another benefit results from the simplified plumbing and standardized installation for truck manufacturers.

[0013] Still other features and benefits of the invention will become apparent to those skilled in the art upon reading and understanding the following detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] **FIGS. 1 and 2** are schematic representations of prior art truck brake systems.

[0015] **FIG. 3** is a schematic representation of the spring brake modulating relay valve of the present invention incorporated into an air brake system.

[0016] **FIG. 4** is a sectional view through the spring brake modulating relay valve illustrating relative positions of the valve components during a system charging.

[0017] **FIG. 5** is a view similar to that of **FIG. 4**, where the pressure has been elevated above 105 psi.

[0018] **FIG. 6** illustrates normal service brake application.

[0019] **FIG. 7** illustrates the position of the valve components during system park.

[0020] **FIG. 8** illustrates service brake application where a failure has occurred in the primary brake circuit.

[0021] **FIG. 9** shows the valve components where a failure in the secondary brake circuit has occurred.

[0022] **FIG. 10** illustrates the anti-compounding feature of the subject valve.

[0023] **FIG. 11** is an illustration of another preferred embodiment of a combined spring brake modulating relay valve.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0024] Turning first to **FIG. 3, a** brake system **20** includes a first or primary reservoir **22** and a second or secondary reservoir **24** that provide a supply of pressurized air for the brake system. The reservoirs are periodically charged by a compressor (not shown) and typically an air dryer is interposed between the compressor and the reservoirs to remove moisture and contaminants from the air before it is stored. Lines **26**, **28** lead from the first and second reservoirs, respectively, to a foot control valve **30**. The valve includes a foot pedal **32** that is selectively depressed by an operator to supply pressure from the foot control valve to a standard service relay valve **40** via line **42**. The relay valve delivers normal service braking to brake chambers **50** via lines **52** associated with each of the drive wheels (not shown). In